Circadian Rhythm Management System, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

The value of measuring sleep-wake cycles is significantly enhanced by measuring other physiological signals that depend on circadian rhythms (such as heart rate and temperature) and environmental conditions that are known zeitgebers, such as light exposure. As a result, a more complete picture of crewmember circadian rhythms and the environmental factors that entrain them will aid in determining adequate sleep levels and the countermeasures necessary to achieve them. In order to maximize safety, performance, and research value, crewmembers are in need of a device that unobtrusively measures sleep-wake cycles alongside environmental factors. This device must measure and communicate these signals while requiring very little crew overhead, a low energy budget, and a radically long battery life. Orbital Research Inc. (Cleveland, OH), with academic and commercial partners, proposes to design and prototype a Circadian Rhythm Measurement System (CRMS). Orbital envisions the CRMS to be a compact, light-weight unit worn on the upper part of the non-dominant arm. In contrast with more common wrist-worn devices, this positioning will provide additional battery space for energy storage and access to rich biological signals (heart rate and skin temperature). A consumer fitness device marketed by Orbital's commercial partner that makes use of upper-arm positioning has proven to be comfortable and inconspicuous to tasks involving the hands. The Orbital CRMS effort will focus on extremely energy-conscious design and minimally obtrusive user experience. The final product will measure sleep/wake cycles alongside heart rate, skin temperature, and light exposure without required intervention for 2 weeks or longer, transmit daily (or more frequent as needed) reports to an ISS computer automatically, and will provide feedback to the user upon request. Orbital will heavily leverage its existing technology and expertise to achieve these design goals.

Circadian Rhythm Management System Project Image

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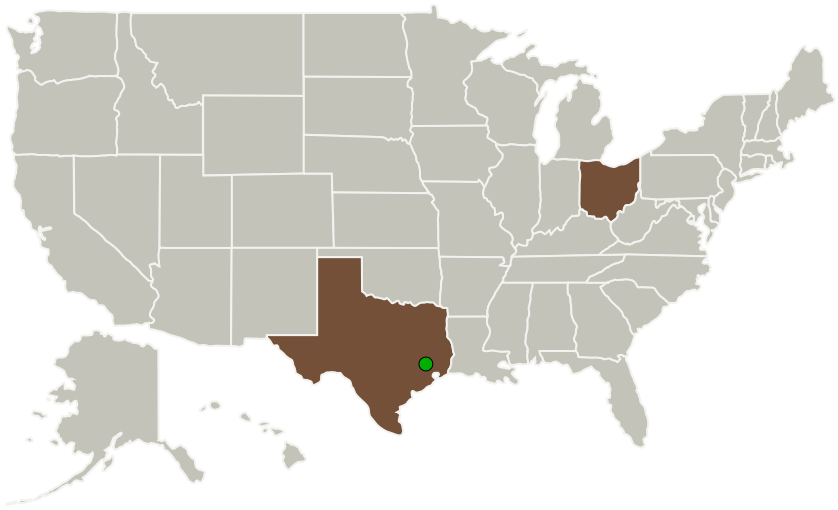
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Orbital Research, Inc.	Lead Organization	Industry	Cleveland, Ohio
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Ohio	Texas

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137583)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Orbital Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

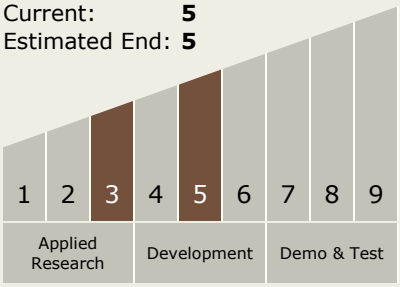
Carlos Torrez

Principal Investigator:

David D Dashevsky

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Images

Project Image
Circadian Rhythm Management System Project Image
(https://techport.nasa.gov/image/126577)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.3 Behavioral Health and Performance

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System